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Is Japanese FDI a Substitute for  
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# Is Japanese FDI a Substitute for or a Complement to Trade in Asia?

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## **Abstract**

This paper analyzes the effects of Japanese FDI on international trade in manufacturing industries during the period 1989-2004. The panel regressions are conducted for the net export of the six selected Asian countries at a sectoral level. The econometric analysis reveals some FDI tends to simulate bilateral trade, while other FDI has a tendency to reduce the volume of bilateral trade. The analysis also reveals that FDI into non-manufacturing sectors and all other manufacturing sectors has spillover effects on trade of manufactured goods in some countries and manufacturing industries. The relationship between capital movement and bilateral trade is not one consistent pattern of substitutability or complementarity but differs across manufacturing sectors and countries in Asia.

**Keywords:** FDI, bilateral trade, substitutability, complementarity, spillover effects

**JEL Classification:** F14, F21

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## 1. Introduction

Growing international linkages through foreign direct investment (FDI) is one of prominent features of contemporary globalization. During the past 10 years, world foreign direct investment has more than tripled. Amidst a global boom in FDI, world FDI, outward flows, amounted to US\$ 877 billion, which is 2.1% of world GDP in 2004 (UNCTAD). Not only trade in products but also trade in capital performs a vital role in increased economic integration. In contemporary world economy characterized by vast flows of both capital and products across countries, it is important to understand the relationship between trade in goods and capital so as to obtain a complete picture of international linkages.

The well-known trade theories of Ricardo and Heckscher-Ohlin explain how product trade could arise among countries given that international labor and capital mobility were absent. In the Ricardian theory, autarky relative prices are determined based on technology and a difference in technology between two countries is the basis for trade, whereas in the Heckscher-Ohlin theory trade occurs because of international differences in relative factor endowments (e.g., the number of units of capital for each unit of labor in the economy). Mundell (1957), in the context of the Heckscher-Ohlin-Samuelson model, studied the substitutability between factor movements and trade. Relaxing the standard H-O-S assumptions such as identical production functions, later theoretical studies show that capital movement and product trade are complements rather than substitutes (Schmitz and Helmberger 1970; Parvis 1972; Svensson 1984; Markusen 1983; Markusen and Svensson 1985). Markusen (1997, 2002) argued that whether direct investment complements or substitutes for trade depends on the type of direct investment. According to the study, if multinationals produce final goods in multiple locations, direct investment tends to substitute for trade, whereas, if multinationals geographically fragment production by stages, FDI tends to promote trade.

Most empirical researches of the relationship between FDI and trade employ data on a single home-country's investment and exports into other countries using a gravity specification. Many of the early empirical studies showed that FDI stimulated exports at a country level or industry level (Swedenborg 1979; Lipsey and Weiss 1981, 1984; Pfaffermayr 1996; Wei and Frankel 1997; Goldberg and Klein 1998; Clausing 2000). However, Blomstrom et al. (1988) found negative coefficients on exports implying some substitution of FDI for exports in some industries. Blederbos and Sleuwagen (1998) found evidence that direct investment substitutes for exports in electronics firms. Considering exports of intermediate goods to a host country from a home country,

empirical evidence is somewhat mixed. Svensson (1996) found a positive relationship between bilateral exports and FDI for finished goods but a negative effect for intermediate goods using data on Swedish multinationals. Head and Ries (2001) also found complementarity between Japanese FDI and exports with substitutability arising for Japanese manufacturing firms that do not export intermediate inputs to host countries. Amiti and Wakelin (2003) introduced investment liberalization as an explanatory variable instead of direct investment. They found that investment liberalization stimulates exports when countries differ in relative factor endowments and trade cost low, while investment liberalization reduces exports when countries are similar in relative factor endowment and size and trade costs are moderately high. Using industry-level data for Japanese FDI, Kawai and Urata (1998) found a complementary effect between export and FDI in some manufacturing industries with substitutability between import and FDI in all manufacturing industries.

Many of empirical studies on FDI and trade have focused on whether FDI complements or substitutes for home country's exports of final goods and therefore, do not point to exports of intermediates as a potential explanation for the frequent finding of complementarity. FDI is also very likely to affect home country's import of final goods as discussed in Markusen (1997, 2002), which is rarely discussed in most of empirical studies. In addition, many of previous empirical studies could not capture the spillover effects of FDI in manufacturing industries. Therefore, empirical analysis by using more disaggregated data is desirable to examine the effect of FDI on levels of both export and import. Goldberg and Klein (1999) provided the first empirical study of this relationship using detailed sectoral data on FDI and trade between the United States and eight Latin American countries. They incorporated the net exports in their analysis as the independent variable to investigate the effects of direct investment flows on exports as well as imports.

This study is the first attempt to analyze the effects of Japanese FDI on trade of both host and source countries at a sectoral level including spillover effects on trade in manufacturing industries. This study investigates the relationship between Japanese FDI and trade based on the framework of Goldberg and Klein (1999) with some modifications during the period 1989-2004. In specific, this paper explores how direct investment from Japan into specific manufacturing sectors as well as into other manufacturing sectors and non-manufacturing sectors of six Asian countries (China, India, Indonesia, Malaysia, the Philippines, Thailand) affects the net exports of those sectors of their economy.

## **2. FDI and Trade Flows**

### **GDP, FDI and Trade of World**

Figure 1 shows growth rates of world FDI (outward) and GDP during the period 1989-2004. As shown in Figure 1, after the sharp slowdown in 2001, world economic growth recovered gradually in 2002 and 2003. In 2004, world economic growth reached 4.94%, the strongest growth rate since 1989. Similarly, world FDI edged up for three consecutive years, 2002, 2003 and 2004 after the sharp slowdown in 2000 and 2001. In 2004, world FDI growth reached 57%, the second strongest growth rate since 1989. World trade, similar to world GDP and world FDI, increased for three years from 2002 to 2004 in a row after the slowdown in 2001. In 2004, world trade growth reached 22%, the strongest growth rate since 1989.

[Figure 1]

### **Japanese FDI and Exports**

Now, we examine Japanese FDI and exports and compare with those of US representing one of the major sources of direct investment in the world. Figure 2 shows the total amount of Japanese and US FDI as well as US and Japanese exports during 1989-2004. As shown in Figure 2, US export recovered gradually in 2003 and 2004 after the slowdown for two consecutive years, 2001 and 2002. Japanese exports increased for three consecutive years, 2002, 2003 and 2004 after the slowdown in 2001. In 2004, both US and Japanese exports climbed up to \$819 billion and \$ 566 billion, the largest amount since 1989, respectively. It is observed that both US and Japanese exports show the upward trend overall during the period 1989-2004. Regarding foreign direct investment, US FDI reached \$209 billion in 1999 and gradually decreased to \$129 billion in 2003. In 2004, US FDI increased again to \$258 billion, the largest amount since 1989. In 1989 and 1990, the amounts of Japanese FDI are greater than US FDI. In 1990, Japanese FDI amounted to \$ 48 billion greater than US FDI, \$ 31 billion. Japanese FDI decreased to \$14 billion in 1993 and increased again to \$31 billion in 2004. It is also observed that Japanese FDI remains relatively stable, while US FDI indicates upward trend overall during the period 1989-2004.

[Figure 2]

## **Japanese FDI by Region**

In this subsection, we explore regional breakdowns of Japanese FDI. Figure 3 shows annual amount of Japanese FDI to three major recipient regions (North America, Asia and Europe). As shown in Figure 3, North America was the largest recipient region of Japanese FDI until 1997. From 1998, Europe became the largest recipient region of Japanese FDI. It is clarified that Japanese FDI to the three major recipient regions has decreased overall during the period 1989-2004. In general, FDI flows to Asia account for 21% of Japanese FDI to the three major recipient regions. Specifically, the main recipient countries are China, Thailand and Korea, respectively accounting for approximately 49%, 13% and 9% of the region's inflows from Japan<sup>1</sup> in 2004.

[Figure 3]

## **Net Export Position**

For the purposes of this study, it is informative to explore the net export position of each manufacturing industry by country. Table 1 provides a general overview of the net export position of the selected Asian countries at a sectoral level. As shown in Table 1, Japan is the net importer in the sector of Food & Kindred Products. Regarding the five other sectors except for Other Manufacturing sectors, the selected Asian countries are net importers. In the four countries besides Malaysia and the Philippines, Machinery Except Electrical sector is the largest import sector, while Electric & Electronic Equipment sector is the largest import sector in Malaysia and the Philippines.

[Table 1]

## **Sectoral Composition of Japanese FDI**

For the purposes of this study, it is also informative to explore sectoral composition of Japanese FDI. Table 2 indicates annual average of Japanese FDI to the selected countries in Asia. As shown in Table 2, China has received the largest amount of Japanese FDI. Electric & Electronic Equipment sector is the most important recipient of Japanese FDI across the selected Asian countries. In India, Transportation Equipment

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<sup>1</sup> This study assumes that a host country is poorly endowed with capital. Thus, Korea is excluded from the study.

sector is the most favored sector of Japanese FDI, while Chemical & Allied Products sector is the most favored one in Indonesia among the manufacturing sectors during the sample period. In Malaysia, the Philippines and Thailand, Electric & Electronic Equipment is the most important sector of capital investment from Japan among the manufacturing sectors during the sample period. With respect to non-manufacturing sectors, China's Service sector is the largest recipient of Japanese FDI and Indonesia's Finance sector is the second largest recipient of Japanese FDI across the selected Asian countries.

[Table 2]

### 3. Theoretical Model

In this section, we develop a mathematical basic model based on the work of Goldberg and Klein (1999) with a few modifications in order to explain the relationship between product trade and capital movements. This model provides a context for our empirical analysis in which FDI to a particular sector affects the volume of exports and imports of that sector as well as other sectors.

Suppose we have one country producing two goods, A and B. The goods are produced with capital,  $K$  which consists of domestic and foreign capital i.e. FDI,  $K_d$  and  $K_f$  and the labor,  $L$ . Domestic capital is assumed to be completely sector specific and a perfect substitute for foreign capital. Unlike capital, labor shifts without any cost from one sector to the other sector in response to an incipient wage differential. Foreign direct investment is assumed to be exogenous and the quantity of product trade is endogenously determined with the level of FDI. The greater the mobility of capital is, the higher the volume of trade is for any given level of production efficiency. Capital and labor used in the production of goods, A and B are denoted as  $K_A$ ,  $L_A$ ,  $K_B$ , and  $L_B$  respectively. The production functions of goods, A and B can be expressed as

$$A: f(K_A, L_A) \quad B: g(K_B, L_B). \quad (1)$$

where the partial derivatives with respect to labor,  $(f_L, g_L)$  and capital,  $(f_K, g_K)$  are positive. The cross-partial derivatives with respect to labor and capital,  $(f_{LK}, g_{LK})$ , also are positive. All of the second partial derivatives,  $(f_{LL}, f_{KK}, g_{LL}, g_{KK})$ , are negative.

With labor perfectly mobile across sectors and the labor market competitive, the wage paid to labor in the Sector A,  $w$ , is the same as the wage paid to labor in the Sector

B. The first-order conditions for profit maximization require that firms in each sector hire labor to the point where the product wage equals the marginal product of labor,

$$w/p_A = f_L \quad w/p_B = g_L \quad (2)$$

Totally differentiating each of these relationships and dividing through by the marginal product of labor, we can obtain as follows

$$\begin{aligned} (dw/w) - (dp_A/p_A) &= (f_{LL}/f_L) dL_A + (f_{LK}/f_L) dK_A \\ (dw/w) - (dp_B/p_B) &= (g_{LL}/g_L) dL_B + (g_{LK}/g_L) dk_B \end{aligned} \quad (3)$$

Full employment and a fixed amount of labor ensure

$$L = L_A + L_B \quad dL_A = -dL_B \quad (4)$$

Solving out the sets of equations for the change in labor in each sector, we get

$$\begin{aligned} dL_A &= (f_{LK}g_L/Z)dK_A - (g_{LK}f_L/Z)dK_B + (f_Lg_L/Z)[(dP_A/P_A) - (dP_B/P_B)] \\ dL_B &= (f_Lg_{LK}/Z)dK_B - (f_{LK}g_L/Z)dK_A + (f_Lg_L/Z)[(dP_B/P_B) - (dP_A/P_A)] \end{aligned} \quad (5)$$

where  $Z = -(f_{LL}g_L + g_{LL}f_L) > 0$ .

These equations imply that capital increase in one sector such as foreign direct investment to that sector ( $dK > 0$ ) pulls labor into that sector reducing the labor employment in the other sector. It suggests that the marginal products of labor and the degree of complementarities between labor and capital in production determine the magnitudes of worker reallocation.

From the production functions, we know

$$\begin{aligned} dA &= f_K dK_A + f_L dL_A \\ dB &= g_K dK_B + g_L dL_B \end{aligned} \quad (6)$$

Substituting for  $dL_A$  and  $dL_B$  in the above equations, we obtain



$$dA = f_L^2 g_L / Z [(dP_A / P_A) - (dP_B / P_B)] + [f_K + (f_{LK} g_L f_L / Z)] dK_A - (f_L^2 g_{LK} / Z) dK_B \quad (7)$$

$$dB = g_L^2 f_L / Z [(dP_B / P_B) - (dP_A / P_A)] + [g_K + (g_{LK} g_L f_L / Z)] dK_B - (g_L^2 f_{LK} / Z) dK_A$$

From the above equations, we can know that an increase in its relative price or capital such as FDI into one sector stimulates output of the sector, whereas a decrease in capital such as FDI into the other sector decreases its output. An inflow of foreign capital into a sector increases sectoral output directly by providing more capital and indirectly by raising the marginal product of its labor and drawing workers away from the other sector. Overall, it can be said that investment to one sector increases production in that sector and decreases production in the other sector.

These results imply that the effects of FDI on trade volumes depend upon whether a sector was initially a net exporter or a net importer. An increase in production in Sector A causes international trade by that sector to increase if that sector was initially a net exporter, or to decrease if that sector was initially a net importer<sup>2</sup>. The converse also holds. In all these cases, direct investment into a sector causes an increase in the net exports of that sector and a decrease in the net exports of other sectors.

## 4. Empirical Analysis

### The Empirical Model and Methodology

In previous section, the model demonstrates the relation between direct investment and trade. Now, taking the theoretical model discussed in the previous section into consideration, we develop regression model in order to estimate the effects of direct investment on trade. We classify the manufacturing industry into seven sectors and add direct investment into non-manufacturing sectors in order to test effects of this type of FDI on the output and trade of manufacturing sectors.

The basic panel regression model used for parameter estimation of Japanese FDI takes the form

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<sup>2</sup> It is assumed that no demand effects exist and relative price effects are second order.

$$\Delta NX_{it} = \alpha_i + \beta_1 \Delta RGDP_{it} + \beta_2 \Delta ORGDP_t + \beta_3 \Delta EXC_t + \beta_4 OFDI_{it-1,t-2} + \beta_5 OTFDI_{it-1,t-2} + u_{it} + v_t \quad (8)$$

where the subscripts refer to sector  $i$  and time  $t$ ;  $\Delta NX$  denotes the change in net exports;  $\Delta RGDP$  denotes the change in real GDP of Japan;  $\Delta ORGDP$  denotes the change in the real GDP of the local countries;  $\Delta EXC$  denotes the change in the real exchange rate<sup>3</sup> of that country;  $OFDI$  denotes the direct investment flow from Japan into sector  $i$ ;  $OTFDI$  denotes the direct investment flow to all manufacturing sectors other than sector  $i$ ;  $\alpha$  is a fixed-effects dummy variable on levels of net exports for manufacturing sector  $i$ ;  $u$  is the error term specific to the particular industry for the particular year;  $v$  is the error term common to all industries in the country for that year.

After adding the explanatory variables of FDI into non-manufacturing sectors, the panel regression model becomes

$$\Delta NX_{it} = \alpha_i + \beta_1 \Delta RGDP_{it} + \beta_2 \Delta ORGDP_t + \beta_3 \Delta EXC_t + \beta_4 OFDI_{it-1,t-2} + \beta_5 OTFDI_{it-1,t-2} + \gamma_1 TRD_t + \gamma_2 FIN_t + \gamma_3 SER_t + u_{it} + v_t \quad (9)$$

where  $TRD$  denotes the direct investment flow to Wholesale Trade sector;  $FIN$  denotes the direct investment flow to Finance sector<sup>4</sup>;  $SER$  denotes the direct investment flow to Service sector<sup>5</sup>.

Panel regressions by country and industry are conducted based on the above two regression models. With respect to panel regressions by country, there exists a possibility of contemporaneous correlation since there are common explanatory variables to all industries in any particular year such as the change of the real exchange rate, domestic income and income of Japan<sup>6</sup>. In order to deal with this problem, the seemingly unrelated regression (SUR) method, which provides robust estimators to the contemporaneous correlation, is used. The regression specifications by country and industry are all the same except for some different methods. When panel regressions by

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<sup>3</sup> In this paper, the real exchange rate (EXC) is defined as the nominal exchange rate (E) that is adjusted by the ratio of the GDP deflators of a local country ( $P^*$ ) to the GDP deflators of Japan ( $P$ ), which can be mathematically shown as  
 $EXC = EP^*/P$

<sup>4</sup> The Finance sector consists of Finance and Insurance sectors

<sup>5</sup> Data sources and definitions are reported in Appendix.

<sup>6</sup> See Kloeck (1981) and Riddell (1981) for the problem of contemporaneous correlation.

industry are conducted, industry dummies are discarded because the left-hand-side variable is the net export data for one industry of several countries. Instead of industry dummies, country dummies are used for panel regressions by industry. Panel regressions by industry do not require the SUR method since the real exchange rate and domestic income of each year are not common to all cross-sectional units<sup>7</sup>.

The signs of four coefficients,  $\beta_1$ ,  $\beta_2$  and  $\beta_4$  are expected to be positive, whereas the sign of the coefficient  $\beta_3$  and  $\beta_5$  are expected to be negative<sup>8</sup>.

## 5. Results and Discussion

Summary results for panel regressions by country using equation (8) and (9) are presented in Table 3 and 4 respectively<sup>9</sup>.

[Table 3]

[Table 4]

The results in Table 3 and Table 4 suggest that own-sector direct investment plays a significant role in promoting net exports in the Philippines. Similarly, the results in Table 4 show that own-sector direct investment plays a significant role in promoting net exports in Indonesia. By summing across rows for each country in Table 1, it is observed that the Philippines and Indonesia have a bilateral trade deficit with Japan with respect to manufactured goods during the sample period. Thus, the results imply that own-sector direct investment reduces imports from Japan for these two countries. This result of own-sector FDI is consistent with the Mundell's analysis explaining that own sector direct investment has the marginal effect of reducing the volume of bilateral trade

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<sup>7</sup> The statistics of the Breusch-Pagan test for income of Japan do not reject the hypothesis of no heteroscedasticity.

<sup>8</sup> A positive sign of the coefficient,  $\beta_4$  suggests that direct investment promotes trade if the country's bilateral trade balance with Japan is negative. Corresponding to Mundell's analysis, in this case, direct investment decreases overall trade by reducing exports from Japan to the particular country (Supposing that the negative overall trade statistic does not shift from a long-standing negative position to a larger positive position because the sample period of this study is not long enough to do). Conversely, a positive value of  $\beta_4$  with a positive trade balance for a country indicates that direct investment to that country promotes trade by expanding an already-existing trade surplus. This corresponds to the situation in the Ricardian model. A negative sign of the coefficient on other-sector direct investment,  $\beta_5$ , combined with a national bilateral trade deficit with Japan suggests that direct investment promotes the volume of trade by increasing trade flows from Japan. Conversely, when a country has a bilateral trade surplus with Japan, direct investment to one sector reducing net exports of other sectors serves to reduce the overall volume of trade.

<sup>9</sup> Appendix Table A1 and Table A2 provide estimates of the individual regression coefficients of the equation (8) and (9).

in some ways. The results in Table 4 show that other-sector direct investment tends to increase imports from Japan in Indonesia, while the results in Table 3 and Table 4 show that the same type of direct investment tends to decrease imports from Japan in the Philippines given a bilateral trade deficit. As shown in the complete results of Appendix TableA2, other-sector direct investment stifles net exports with a one-year lag but other-sector direct investment promotes net exports with a two-year lag in Indonesia and the Philippines. This result may arise from following reasons. At first, other-sector investment causes to decrease the output of own sectors by labor allocation across sectors after one year as discussed in the theoretical model and then, after two year, other-sector investment leads to increase the output of own sectors through positive spillover effects. In Indonesia, as shown in Table 4, the negative effect of other-sector investment mitigates, but does not reverse, the positive effects of own-sector direct investment because the sum of the coefficients on other-sector direct investment, -0.280, although statistically insignificant, does not exceed the sum of the coefficients on own-sector direct investment, 15.840 in absolute value. Therefore, it is clarified that overall effects of FDI to the Philippines and Indonesia are to reduce the volume of bilateral trade. The estimation results in Table 3 also suggest that other-sector direct investment tends to reduce net exports in India. India has a bilateral trade surplus with Japan with respect to manufactured goods during the sample period. This negative effect of other-sector direct investment mitigates the positive effect of own-sector direct investment since the sum of the coefficient on other-sector direct investment, -1.051 does not exceed the sum of the coefficient on own-sector direct investment, 42.874, although statistically insignificant, in absolute value. Therefore, the marginal effect of direct investment is to increase the volume of bilateral trade in manufacturing goods in India. The results in Table 3 and 4 suggest that other-sector direct investment tends to promote net exports in Malaysia and Thailand, respectively. For Malaysia, the marginal effect of direct investment is to reduce net exports and thus, increase the volume of bilateral trade in manufacturing goods because the coefficient on own-sector direct investment, -0.030 is greater in absolute value than the coefficient on other-sector direct investment, 0.026. For Thailand, the marginal effect of direct investment is to promote net exports and thus, reduce the volume of bilateral trade in manufacturing goods due to a trade deficit with Japan.

Now, the effects of direct investment into non-manufacturing sectors on the trade in commodities are considered. This type of direct investment affects output of manufacturing sectors directly and indirectly in some ways. Labor allocation, as described in the theoretical model, across sectors affects output of manufacturing

sectors. Some output of manufacturing sectors possibly serves as input of non-manufacturing sectors. FDI into non-manufacturing sectors has also influence on output of manufacturing sectors through spillover effects<sup>10</sup>. Similar to the effects of direct investment to manufacturing sectors on the volume of bilateral trade, the effect of direct investment to non-manufacturing sectors depends on whether a host country has a trade surplus or a trade deficit in manufactured goods with a home country. If a host country has a trade surplus in manufactured goods with a home country, a positive and significant coefficient implies that this kind of direct investment causes an increase in the volume of bilateral trade, while a negative and significant coefficient implies that this type of direct investment serves to decrease the volume of bilateral trade. Conversely, in case of a trade deficit country in manufactured goods with a home country, the positive and significant coefficient implies that direct investment to non-manufacturing sectors serves to decrease the volume of bilateral trade and the negative and significant coefficient implies that direct investment causes an increase in the volume of bilateral trade.

Direct investment to the Wholesale trade sector has a positive and significant effect on trade by manufacturing sectors in India and Indonesia. In India, direct investment to this sector tends to increase the volume of bilateral trade due to a trade surplus, while direct investment to this sector tends to decrease the volume of bilateral trade due to a trade deficit. However, direct investment to this sector has a negative and significant effect on trade by manufacturing sectors in Malaysia, the Philippines and Thailand. In these three countries, direct investment to the sector increases the volume of bilateral trade due to trade deficits in manufactured goods with Japan. Direct investment to the Finance sector has a positive and significant effect on trade in manufactured goods in India and Malaysia, while direct investment to this sector has a negative and significant effect on trade by manufacturing sectors in China. Direct investment to the Finance sector tends to increase the volume of bilateral trade in India having a trade surplus in manufactured goods with Japan, while FDI to this sector tends to decrease the volume of bilateral trade in Malaysia, a trade deficit country with Japan. FDI to this sector tends to decrease the volume of bilateral trade in China. In the Philippines, the coefficient of direct investment to the Service sector shows a negative and significant sign, which implies that FDI to this sector tends to raise the volume of bilateral trade in manufactured goods.

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<sup>10</sup> Not only the transfer of technology and management skills but also the transfer of knowledge of world markets and ways of fitting into worldwide production networks, not visible in standard productivity measurements, also increases efficiency in production.

The second group of regressions is conducted on data grouped by industry<sup>11</sup>. Table 5 and 6 present panel regression results for the cumulative effects of lagged independent variables.

[Table 5]

[Table 6]

In Table 5, for the Chemical & Kindred Products, the Primary & Fabricated Metals and the Electric Equipment sectors, the coefficients on own-sector direct investment show negative and significant signs, while the coefficients on other-sector direct investment show positive and significant signs. Given trade deficits in these three sectors with Japan, the positive coefficients on own-sector investment suggest that direct investment into own sector increases Japanese export to the six Asian countries. This trade-creating effect may arise from increase Japanese exports of intermediate inputs in order to produce final products of these sectors. Whereas, the negative coefficients on other-sector investment imply that direct investment into other sector decreases Japanese exports. This trade-diminishing effect of other-manufacturing-sector direct investment may occur because the output of these three sectors increases through spillover effects. For the Chemical & Kindred Products sector, this positive spillover effects are mitigated after two years because FDI to industries other than this industry had negative effects on trade in this industry after two year as shown in the complete estimation results presented in Appendix Table A3 and A4. The overall effects of direct investment in all of these three sectors are to increase the volume of trade because the coefficients on own-sector direct investment, -8.773, -17.881 and -6.749 exceed the coefficients on other-sector investment, 0.303, 2.459 and 3.287 in absolute value, respectively. Conversely, for the Other Manufacturing sectors in Table 5, the own-sector direct investment stimulates net exports while, the other-manufacturing-sector direct investment stifles net exports. The overall effect of direct investment is to promote net exports because the coefficient on own-sector direct investment, 3.812, exceeds the coefficient on other-sector investment, -0.473 in absolute value. Given a trade surplus in the Other Manufacturing sectors with Japan, it suggests that direct investment increases the volume of bilateral trade. In Table 6, for the Transportation Equipment sector, the overall effect of direct investment is to promote

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<sup>11</sup> Appendix Table A3 and Table A4 provide the complete estimation results.

net exports. Given a trade deficit in this sector with Japan, it suggests that direct investment to this sector reduces imports from Japan and, thus, decreases the volume of bilateral trade.

Finally, effects of direct investment into non-other manufacturing by industry are considered. As shown in Table 6, direct investment to the Wholesale Trade sector tends to stimulate net exports in the Primary & Fabricated Metals sector and the Transportation Equipment sector, while this type of FDI tends to reduce net exports in the Other Manufacturing sector. Direct investment to the Finance sector stifles net exports in the Chemical & Allied Products sector and Transportation Equipment sector. Direct investment to the Service sector stifles net exports in the Machinery Except Electrical sector and the Transportation Equipment sector, while this type of FDI increase net exports in the Primary & Fabricated Metals sector.

## 6. Concluding Remarks

The effects of capital movements on international trade have been open to controversy in both theoretical and empirical studies. The early theoretical study showed FDI and trade may serve as substitutes, whereas the later theoretical research demonstrated that FDI and trade are complements other than substitutes. However, many of empirical studies show somewhat mixed results on the relationship between FDI and trade.

This study aims to examine empirically the linkages between trade in manufactured goods and Japanese FDI together with spillover effects of FDI in Asia. The empirical findings offer important aspects of the linkages between Japanese FDI and trade. The empirical analysis reveals that some FDI tends to raise the volume of manufacturing trade but other FDI has a tendency to diminish the volume of bilateral trade. That is, foreign direct investment and product trade can be both substitutes and complements in manufacturing industries. For instance, FDI tends to diminish the volume of bilateral trade in the Philippines, Indonesia and Thailand whereas FDI increases the volume of bilateral trade in India and Malaysia. Similarly, some FDI has a tendency to promote net exports in some sectors such as the Transportation Equipment sector and the Other Manufacturing sectors, while other FDI stifles the net exports in some sectors such as the Chemical & Allied Products, the Primary & Fabricated Metals sector and the Electric & Electronic Equipment sector. Furthermore, the empirical analysis also reveals that some FDI into other-manufacturing sectors and non-manufacturing sectors has the positive spillover effects on bilateral trade and some FDI has trade-creating effects of intermediate goods

Consequently, it can be concluded that Japanese FDI can lead to significant and various effects on bilateral trade across manufacturing industries in Asian countries rather than homogeneity of either substitutability or complementarity.



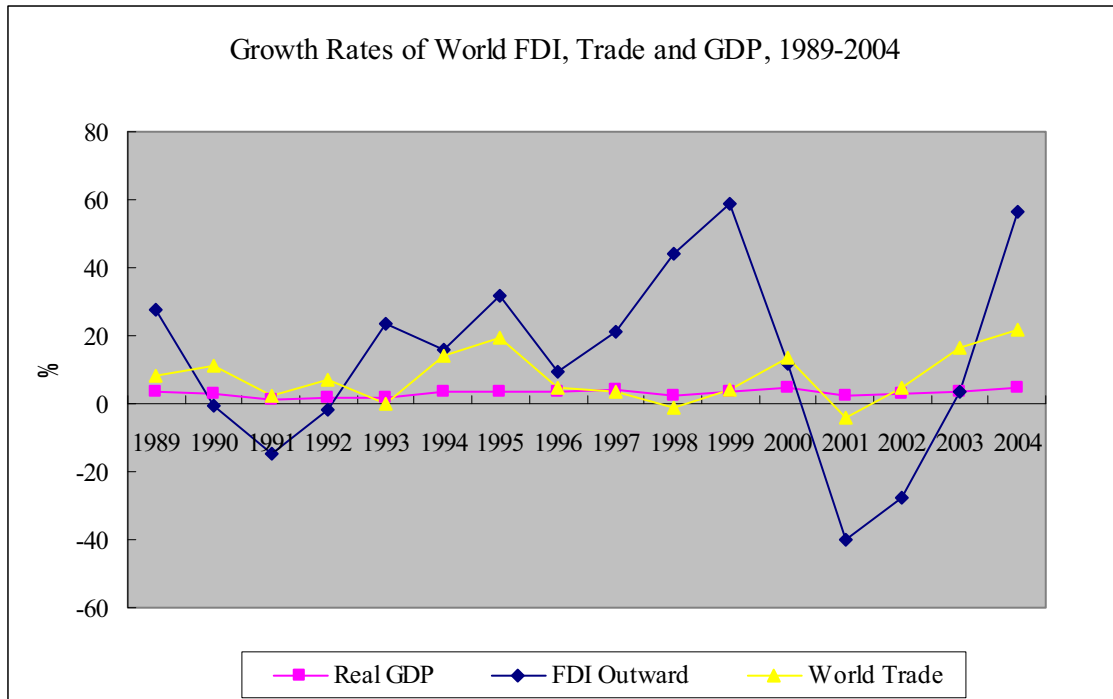
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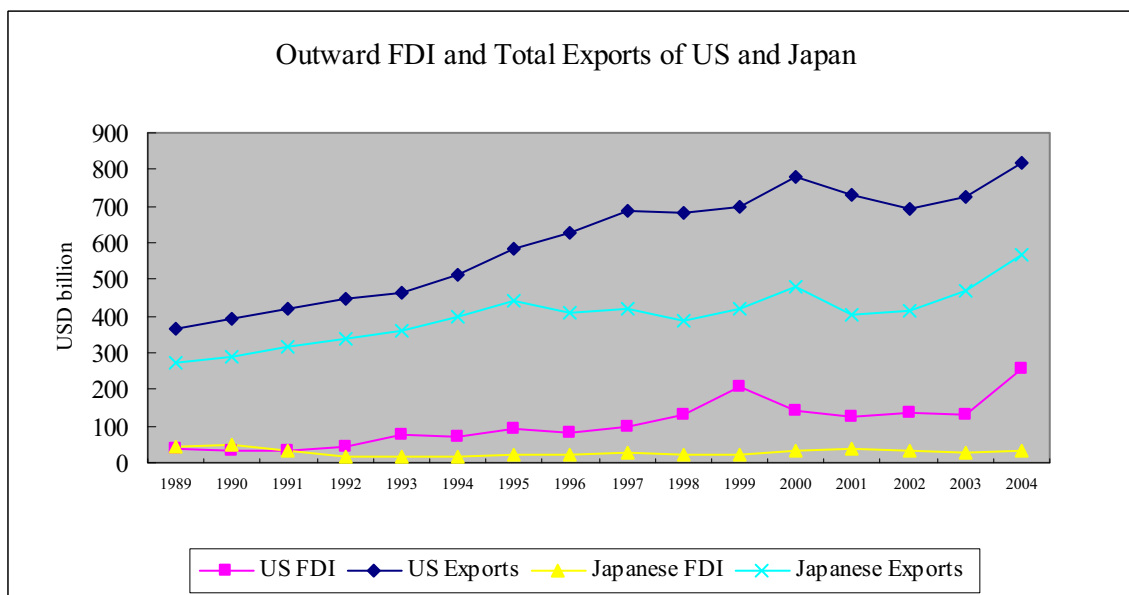
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**Figure 1: Growth Rates of World FDI (outward), Trade and GDP, 1989-2004**



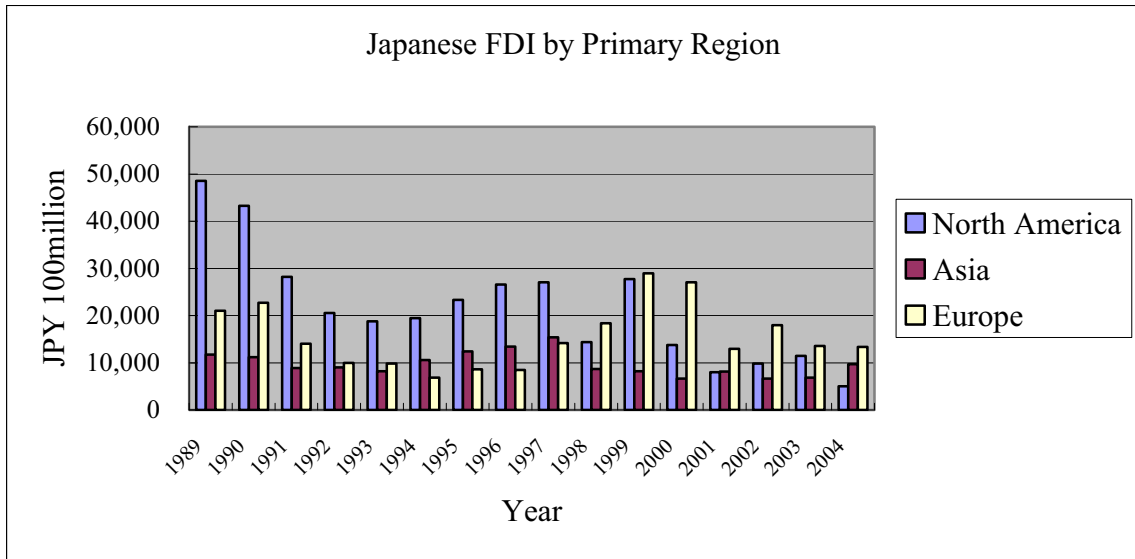
Note: World trade is calculated by adding total imports and total exports of world.  
 Sources: UNCTAD ([www.unctad.org](http://www.unctad.org)) for FDI, WTO ([www.wto.org](http://www.wto.org)) for Trade and IMF, *World Economic Outlook Database*, April 2006 for GDP

**Figure 2: Outward FDI and Total Exports of US and Japan**



Note: These amounts are based on current prices.  
 Sources: UNCTAD ([www.unctad.org](http://www.unctad.org)) for FDI and WTO ([www.wto.org](http://www.wto.org)) for Export

**Figure 3: Japanese FDI by Primary Region**



Source: Ministry of Finance Japan (<http://www.mof.go.jp>)

**Table 1: Net Export Position of Asian Countries (1989-2004)**

100 Millions of 2000 JPY

	Food & Kindred Products	Chemical & Allied Products	Primary & Fabricated Metals	Machinery Except Electrical	Electric & Electronic Equipment	Transportation Equipment	Other Manufacturing
China	82750	-27840	-26177	-48820	-17224	-20556	60929
India	10467	-3273	-3659	-12222	-6317	-3383	23840
Indonesia	20442	-9768	-3271	-36899	-11763	-16964	190024
Malaysia	2434	-8312	-20615	-20047	-33497	-22677	84025
Philippines	13394	-6018	-6256	-9013	-20340	-14014	4848
Thailand	39902	-15631	-30210	-43004	-31292	-31831	10016

Source: Ministry of Finance Japan (<http://www.mof.go.jp>)

**Table 2: Sectoral Composition of Annual Average of Japanese FDI in Asia (1989-2004)**

100Millions of 2000 JPY

	Food & Kindred Products	Chemical & Allied Products	Primary & Fabricated Metals	Machinery Except Electrical	Electric & Electronic Equipment	Transportation Equipment	Other Manufacturing	Trade	Finance	Services
China	81.654	121.848	136.118	196.625	377.77	294.199	380.904	106.142	39.188	171.959
India	1.1711	20.931	3.53	7.597	16.316	65.345	22.668	5.424	6.509	7.797
Indonesia	12.396	263.588	76.575	14.712	77.643	130.738	55.828	11.647	167.456	90.183
Malaysia	15.203	62.46	61.508	35.923	178.354	14.135	130.502	32.171	39.713	43.581
Philippines	55.624	24.672	31.47	22.866	135.008	49.789	35.968	7.003	26.410	28.531
Thailand	35.482	87.228	131.473	73.289	200.07	166.249	136.843	81.007	53.036	49.950

Source: Ministry of Finance Japan (<http://www.mof.go.jp>)

**Table 3: Estimation Results for Japanese FDI: Summed Two-Period Effects**

<b>Panel A</b>	China	India	Indonesia	Malaysia	Philippine	Thailand
Own Industry	-3.255	42.874	1.780	-0.030	0.180**	1.381
FDI	(-0.372)	(1.110)	(0.250)	(-0.249)	(2.003)	(0.575)
FDI to all other	0.460	-1.051**	-0.001	0.026*	0.199	0.164
Industries	(0.646)	(-2.011)	(-0.004)	(1.809)	(1.559)	(0.448)
Obs	98	98	98	98	98	98

Notes: The dependant variable is the net exports of a local country. Parentheses ( ) shows *t*-statistics with levels of significance\*\*\* (1%) \*\* (5%) \* (10%)

**Table 4: Estimation Results for Japanese FDI: Summed Two-Period Effects**

<b>Panel B</b>	China	India	Indonesia	Malaysia	Philippine	Thailand
Own Industry	-5.185	25.454	15.840*	-0.012	0.321***	1.248
FDI	(-0.515)	(0.790)	(1.662)	(-0.078)	(7.259)	(0.584)
FDI to all other	0.649	-0.147	-0.280	0.037	0.005	0.466*
Industries	(0.942)	(-0.293)	(-1.263)	(1.097)	(0.123)	(1.917)
FDI to Wholesale Trade	-4.244	29.020***	13.785***	-0.105**	-1.201*	-2.390**
	(-1.012)	(2.997)	(3.909)	(-2.309)	(-1.825)	(-2.364)
FDI to Finance	-7.421*	13.318***	-0.035	0.149*	-0.113	-1.419
	(1.626)	(3.982)	(-0.214)	(1.940)	(-1.036)	(-0.564)
FDI to Services	2.297	0.914	-0.473	-0.374	-3.990***	4.949
	(0.778)	(0.305)	(-0.853)	(-1.094)	(-13.091)	(1.575)
Obs	98	98	98	98	98	98

Notes: The dependant variable is the net exports of a local country. Parentheses ( ) shows *t*-statistics with levels of significance\*\*\* (1%) \*\* (5%) \* (10%)



**Table 5: Estimation Results for Japanese FDI: Summed Two-Period Effects**

<b>Panel A</b>	Food & Kindred Products	Chemical & Allied Products	Primary & Fabricated Metals	Machinery Except Electrical	Electric & Electronic Equipment	Transportation Equipment	Other Manufacturing
Own Industry	-3.265	-8.773***	-17.881*	-1.231	-6.749***	-2.972	3.812***
FDI	(-0.358)	(-10.791)	(-1.778)	(-0.197)	(-3.467)	(-0.837)	(3.224)
FDI to all other Industries	0.461 (0.629)	0.303*** (8.116)	2.459** (2.203)	0.438 (0.431.)	3.287*** (5.259)	0.619 (1.315)	-1.473** (-2.619)
Obs	84	84	84	84	84	84	84

Notes: The dependant variable is the net exports of a local country. Parentheses ( ) shows *t*-statistics with levels of significance\*\*\* (1%) \*\* (5%) \* (10%)

**Table 6: Estimation Results by for Japanese FDI: Summed Two-Period Effects**

<b>Panel B</b>	Food & Kindred Products	Chemical & Allied Products	Primary & Fabricated Metals	Machinery Except Electrical	Electric & Electronic Equipment	Transportation Equipment	Other Manufacturing
Own Industry	-5.185	-4.914***	-9.539	7.317	-6.757***	4.708**	5.532
FDI	(-0.510)	(-8.173)	(-0.793)	(1.015)	(-3.505)	(2.256)	(1.121)
FDI to all other Industries	0.649 (0.932)	0.308*** (8.349)	0.808 (0.569)	-0.583 (-0.523)	3.405*** (4.774)	-0.730** (-2.373)	-1.801 (-0.874)
FDI to Wholesale Trade	-4.244 (-1.001)	-0.392 (-1.108)	6.695** (2.030)	-1.136 (-0.291)	0.724 (0.216)	8.359*** (5.321)	-5.488* (-1.728)
FDI to Finance	-7.421 (-1.609)	-2.003*** (-3.188)	1.429 (0.266)	-7.187 (-1.035)	-5.412 (-0.831)	-5.238** (-2.086)	-2.007 (0.161)
FDI to Services	2.297 (0.770)	-0.075 (-0.224)	8.377** (2.573)	-8.610** (-2.075)	-5.499 (-1.567)	-2.729* (-1.790)	-0.861 (-0.383)
Obs	84	84	84	84	84	84	84

Notes: The dependant variable is the net exports of a local country. Parentheses ( ) shows *t*-statistics with levels of significance \*\*\* (1%) \*\* (5%) \* (10%)

## **Appendix**

### **The Data for Japanese FDI Analysis**

The panel data set for Japanese FDI consists of the six Asian countries such as China, India, Indonesia, Malaysia, the Philippines and Thailand) and sixteen years of data (1989-2004). Manufacturing industry is broken down into seven sectors such as Food and Kindred Products, Chemicals and Allied Products, Primary and Fabricated Metals, Industrial Machinery and Equipment, Electronic and Other Electric Machinery, Transportation and Other Manufacturing (residual category) to make the sector definitions consistent across the trade and FDI series. Data for FDI into non-manufacturing sectors are comprised of Wholesale Trade, Finance and Service.

The data of FDI into the six Asian countries from Japan are outward capital flows showing positive value. The data of FDI are from the homepage of Ministry of Finance Japan (<http://www.mof.go.jp>)

The data of net exports are calculated by subtracting the value of Japanese export to a given country from the value of Japanese import from the country. The data of the value of both Japanese export and import are from the homepage of Ministry of Finance Japan (<http://www.mof.go.jp>)

The GDP data for an individual Asian country together with Japanese GDP are used as millions of real local currency units. The GDP data for an individual Asian country including Japan are from the database of International Financial Statistics.

The data of the exchange rate for each currency are converted into Japanese yens. The data of the exchange rate for all currencies are from the database of International Financial Statistics.

Trade, investment and Japanese income series are converted into real dollar values using producer price index. The incomes of the selected countries are also converted into real values using producer price index of each country.

## Estimation Results

**Table A1: Estimation Results by Country for Japanese FDI**

	China	India	Indonesia	Malaysia	Philippine	Thailand
Own Industry	-3.674	18.772	3.486	-0.134*	0.181**	2.662
FDI	(-0.406)	(0.819)	(1.062)	(-1.859)	(2.011.)	(1.250)
(one period lag)						
Own Industry	0.419	24.102	-1.706	0.104	-0.001	-1.281
FDI	(0.105)	(1.060)	(-0.229)	(1.233)	(-0.006)	(-0.655)
(two period lag)						
FDI to all other	0.304**	-0.559*	-0.061	0.053**	0.025	0.452
Industries	(1.977)	(-1.793)	(-0.276)	(2.047)	(0.177)	(1.133)
(one period lag)						
FDI to all other	0.156	-0.482	0.060	-0.027	0.174	-0.288
Industries	(0.240)	(-1.181)	(0.614)	(-1.056)	(1.149)	(-1.343)
(two period lag)						
Real Exchange	-5217.328	41.509	-355868.0	0.174	626.735	8005.670
Rate	(-0.681)	(0.016)	(-1.180)	(0.002)	(0.285)	(-0.762)
Real GDP of	0.165	-0.008	0.001	0.006	0.017	-0.121
Japan	(0.818)	(-0.191)	(0.021)	(1.240)	(0.959)	(-1.439)
Local Real	-2.558	0.558	0.014**	0.420	-2.685	6.119
GDP	(-0.407)	(0.592)	(2.077)	(0.114)	(-1.067)	(1.101)
Adj R <sup>2</sup>	0.233	0.236	0.610	0.468	0.358	0.248
Obs	98	98	98	98	98	98

Notes: The dependant variable is the net exports of a local country. Parentheses ( ) shows *t*-statistics with levels of significance\*\*\* (1%) \*\* (5%) \* (10%)

**Table A2: Estimation Results by Country for Japanese FDI**

	China	India	Indonesia	Malaysia	Philippine	Thailand
Own Industry	-2.568	-21.050	3.832	-0.143**	0.051*	2.996**
FDI	(-0.229)	(-0.706)	(1.363)	(-2.523)	(1.834)	(2.017)
(one period lag)						
Own Industry	-2.617	46.504***	12.008	0.131	0.270***	-1.748
FDI	(-0.633)	(2.704)	(1.464)	(1.006)	(7.729)	(-1.022)
(two period lag)						
FDI to all other	0.450*	-0.524*	-0.557*	0.052	-0.119***	0.578*
Industries	(1.632)	(-1.911)	(-1.732)	(0.928)	(-2.759)	(1.978)
(one period lag)						
FDI to all other	0.199	0.377	0.277**	-0.015	0.124**	-0.112
Industries	(0.310)	(0.999)	(2.081)	(-0.548)	(2.634)	(-0.665)
(two period lag)						
Real Exchange	-4055.618	-2825.004	-1202397.0**	-102.968	-1478.438**	-1642.209
Rate	(-0.762)	(-1.218)	(-2.502)	(-0.932)	(-2.086)	(-0.123)
Real GDP of	0.088	-0.040	0.079*	0.016**	0.012**	-0.205**
Japan	(0.347)	(0.802)	(1.672)	(2.248)	(1.998)	(-2.597)
Local Real	24.357*	-0.993	0.022***	-10.320	-7.056***	-1.787
GDP	(1.832)	(-1.380)	(4.634)	(-1.552)	(-7.217)	(0.436)
FDI to	-4.244	29.020***	13.785***	-0.105**	-1.201*	-2.390**
Wholesale Trade	(-1.012)	(2.997)	(3.909)	(-2.309)	(-1.825)	(-2.364)
FDI to Finance	-7.421*	13.318***	-0.035	0.149*	-0.113	-1.419
	(1.626)	(3.982)	(-0.214)	(1.940)	(-1.036)	(-0.564)
FDI to Services	2.297	0.914	-0.473	-0.374	-3.990***	4.949
	(0.778)	(0.305)	(-0.853)	(-1.094)	(-13.091)	(1.575)
Adj R <sup>2</sup>	0.397	0.840	0.844	0.700	0.957	0.711
Obs	98	98	98	98	98	98

Notes: The dependant variable is the net exports of a local country. Parentheses ( ) shows *t*-statistics with levels of significance\*\*\* (1%) \*\* (5%) \* (10%)

**Table A3: Estimation Results by Sector for Japanese FDI**

	Food & Kindred Products	Chemical & Allied Products	Primary & Fabricated Metals	Machinery Except Electrical	Electric & Electronic Equipment	Transportation Equipment	Other Manufacturing
Own Industry FDI (one period lag)	-3.674 (-0.440)	-9.113*** (-13.964)	-5.535 (-0.736)	2.500 (0.701)	1.835 (0.792)	1.909 (1.597)	1.355** (2.107)
Own Industry FDI (two period lag)	0.419 (0.110)	4.340*** (5.035)	-12.346 (-1.399)	-3.731 (-0.979)	-8.584*** (-4.659)	-4.881* (-1.620)	2.457** (2.596)
FDI to all other Industries (one period lag)	0.304 (1.081)	0.461*** (10.730)	0.362 (0.375)	-0.846 (-1.541)	0.013 (0.017)	0.083 (0.324)	-0.661** (-1.922)
FDI to all other Industries (two period lag)	0.156 (0.263)	-0.158*** (-3.256)	2.097* (1.749)	1.284 (1.591)	3.274** (2.579)	0.536 (1.299)	-0.812** (-2.189)
Real Exchange Rate	-5217.318 (-0.910)	-545.766 (-0.736)	-3111.763 (-0.479)	6650.435 (1.116)	-7164.228 (-0.640)	5960.928 (1.279)	5356.240 (1.525)
Real GDP of Japan	0.165 (0.788)	-0.259*** (-8.761)	0.061 (0.282)	-0.369* (-1.654)	0.265 (0.688)	-0.223 (-1.103)	0.165 (1.209)
Local Real GDP	-2.558 (-0.334)	-5.799*** (-3.902)	-1.527 (-0.148)	1.495 (0.195)	-4.280 (-0.356)	-15.273 (-1.538)	26.354*** (3.717)
Adj R <sup>2</sup>	0.296	0.978	0.314	0.507	0.756	0.477	0.667
Obs	84	84	84	84	84	84	84

Notes: The dependant variable is the net exports of a local country. Parentheses ( ) shows *t*-statistics with levels of significance\*\*\* (1%) \*\* (5%) \* (10%)

**Table A4: Estimation Results by Sector for Japanese FDI**

	Food & Kindred Products	Chemical & Allied Products	Primary & Fabricated Metals	Machinery Except Electrical	Electric & Electronic Equipment	Transportation Equipment	Other Manufacturing
Own Industry FDI (one period lag)	-2.568 (-0.277)	-8.388*** (14.425)	5.064 (0.727)	7.349* (1.772)	1.800 (0.889)	3.080*** (5.074)	2.215 (1.503)
Own Industry FDI (two period lag)	-2.617 (-0.626)	3.474*** (4.372)	-14.603 (-1.578)	-0.032 (-0.007)	-8.557*** (-4.717)	1.628 (0.925)	3.317 (0.931)
FDI to all other Industries (one period lag)	0.450 (1.615)	0.453*** (10.421)	-1.515* (-1.711)	-0.920 (-1.498)	0.351 (0.330)	-0.262* (-1.649)	-0.792* (-0.727)
FDI to all other Industries (two period lag)	0.199 (0.307)	-1.046*** (-4.159)	2.323 (1.774)	0.337 (0.370)	3.054** (2.575)	-0.468** (-1.860)	-1.009 (-1.005)
Real Exchange Rate	-4055.618 (-0.753)	-609.014 (0.943)	4374.207 (0.703)	-230.159 (-0.031)	-11597.00 (-1.075)	4700.186 (1.525)	2083.014 (0.364)
Real GDP of Japan	0.088 (0.343)	-0.220*** (-6.634)	-0.590** (-2.176)	0.191 (0.530)	0.580 (1.404)	-0.311* (-2.127)	0.356* (1.776)
Local Real GDP	24.357* (1.813)	-0.950 (-0.531)	12.557 (0.731)	1.753 (0.091)	-7.125 (-0.373)	-39.719*** (-4.325)	41.514*** (4.463)
FDI to Wholesale Trade	-4.244 (-1.001)	-0.392 (-1.108)	6.695** (2.030)	-1.136 (-0.291)	0.724 (0.216)	8.359*** (5.321)	-5.488* (-1.728)
FDI to Finance	-7.421 (-1.609)	-2.003*** (-3.188)	1.429 (0.266)	-7.187 (-1.035)	-5.412 (-0.831)	-5.238** (-2.086)	-2.007 (0.161)
FDI to Services	2.297 (0.770)	-0.075 (-0.224)	8.377** (2.573)	-8.610** (-2.075)	-5.499 (-1.567)	-2.729* (-1.790)	-0.861 (-0.383)
Adj R <sup>2</sup>	0.385	0.989	0.674	0.621	0.814	0.882	0.769
Obs	84	84	84	84	84	84	84

Notes: The dependant variable is the net exports of a local country. Parentheses ( ) shows *t*-statistics with levels of significance \*\*\* (1%) \*\* (5%) \* (10%)